

What is claimed is:

1. A method for determining a blood group type of an individual by direct typing on an optical bio-disc comprising:
 - applying red blood cells to at least one chamber in the optical bio-disc, the chamber surface including at least one capture field including a capture antibody, at least one positive control field, and at least one negative control field;
 - incubating the samples in the disc to promote antigen-antibody interaction;
 - placing the disc into an optical reader that supports it on a first side;
 - rotating the disc about an axis substantially perpendicular to the first side to separate non-captured cells from captured cells located on the chamber surface;
 - obtaining a measurement for the test field, the positive control field, and the negative control field
 - analyzing the measurement of the test field, the positive control field and the negative control field to determine blood group type of the individual.
2. A method for determining the presence of antibodies to an ABO blood group of an individual's blood sample by reverse-typing on an optical bio-disc including:
 - purifying serum from a blood sample;
 - creating at least one sample by mixing serum with cells of a known ABO blood group;
 - injecting at least one sample into at least one channel in the optical bio-disc, thereby delivering the sample onto a capture field including a cell binding molecule;
 - incubating the sample on the capture field to allow the agglutinated and non-agglutinated cells to bind to the cell binding molecule;
 - placing the disc into an optical reader that supports it on a first side;
 - rotating the disc about an axis substantially perpendicular to the first side;

scanning the chamber with an incident beam of electromagnetic radiation by rotating the disc about an axis substantially perpendicular to the first side by moving the incident beam in a direction radial to the axis;
 detecting a return beam of electromagnetic radiation formed by at least a part of the incident beam after interacting with the disc;
 converting the return beam into an output signal;
 analyzing the output signal to determine the presence of cells bound on the capture field; and
 determining the presence of antibodies in the sample.

3. A method for determining the presence of antibodies to an ABO blood group of an individual's blood sample by reverse-typing on an optical bio-disc comprising:
 applying a blood sample to at least one microfluidic channel in the optical bio-disc including a separation chamber with at least one microfilter, at least one mixing chamber, and at least one capture chamber;
 spinning for a first time the disc at a first speed to effect separation of the blood sample into cells and serum in the separation chamber;
 spinning for a second time the disc at a second speed higher than the first, the second speed effecting movement of the serum through the microfluidic channel into a mixing chamber;
 adding cells of a known ABO blood group cells into the mixing chamber containing serum;
 spinning for a third time the disc in one direction and alternately in another direction at least once to effect mixing of the serum and the cells;
 incubating the cells in the serum for a sufficient period of time to allow antibody-antigen binding;
 spinning for a fourth time the disc at a third speed higher than the second, the third speed effecting movement of the cells into of a capture chamber, the capture chamber including surface with a molecule that binds cells;
 incubating the sample in the capture chamber to promote cell binding to the chamber surface;

spinning the disc for a fifth time to remove non-bound cells from the capture field;

scanning the chamber with an incident beam of electromagnetic radiation by rotating the disc about an axis substantially perpendicular to the first side by moving the incident beam in a direction radial to the axis;
 detecting a return beam of electromagnetic radiation formed by at least a part of the incident beam after interacting with the disc;
 converting the return beam into an output signal;
 analyzing the output signal to determine the presence of agglutinated cells; and
 determining the presence of antibodies in the sample.

4. A method for determining the presence of antibodies to a blood group type in an individual by antibody-typing on an optical bio-disc comprising:

purifying serum from a blood sample;
 creating at least one sample by mixing serum with cells of a known blood group phenotype;
 injecting at least one sample into at least one channel in the optical bio-disc, thereby delivering the sample onto a capture field including a cell binding molecule;
 incubating the sample on the capture field to allow the cells to bind to the cell binding molecule;
 placing the disc into an optical reader that supports it on a first side;
 rotating the disc about an axis substantially perpendicular to the first side;
 scanning the chamber with an incident beam of electromagnetic radiation by rotating the disc about an axis substantially perpendicular to the first side by moving the incident beam in a direction radial to the axis;
 detecting a return beam of electromagnetic radiation formed by at least a part of the incident beam after interacting with the disc;
 converting the return beam into an output signal;
 analyzing the output signal to determine the presence of cells bound to the capture field; and

determining the presence of blood group antibodies.

5. A method for determining the presence of antibodies to a blood group type in an individual by reverse-typing on an optical bio-disc comprising:
 - applying a blood sample to at least one microfluidic channel in the optical bio-disc including a separation chamber with at least one microfilter, at least one mixing chamber, and at least one capture chamber;
 - spinning for a first time the disc at a first speed to effect separation of the blood sample into cells and serum in the separation chamber;
 - spinning for a second time the disc at a second speed higher than the first, the second speed effecting movement of the serum through the microfluidic channel into a mixing chamber;
 - adding cells of a known blood group cell phenotype into the mixing chamber containing serum;
 - spinning for a third time the disc in one direction and alternately in another direction at least once to effect mixing of the serum and the cells;
 - incubating the cells in the serum for a sufficient period of time to allow antibody-antigen binding;
 - spinning for a fourth time the disc at a third speed higher than the second, the speed effecting movement of the cells into of a capture chamber, the capture chamber including a surface with an anti-human immunoglobulin molecule;
 - incubating the sample in the capture chamber to promote cell binding to the chamber surface;
 - spinning for a fifth time the disc to remove non-bound cells;
 - scanning the chamber with an incident beam of electromagnetic radiation by rotating the disc about an axis substantially perpendicular to the first side by moving the incident beam in a direction radial to the axis;
 - detecting a return beam of electromagnetic radiation formed by at least a part of the incident beam after interacting with the disc;
 - converting the return beam into an output signal;
 - analyzing the output signal to determine if the cells are agglutinated; and

- determining the presence of blood group antibodies.
6. An apparatus for determining a blood group type of an individual comprising:
an optical bio-disc including at least one capture chamber including:
a layer including a first capture antibody, and
a layer including a second capture antibody bound by the first
capture antibody, the second capture antibody being specific for
a blood group antigen;
a disc drive assembly;
an optical reader; and
software for blood group analysis.
7. An optical-bio disc for performing a blood-typing assay, said disc comprising:
a substrate;
a separation chamber associated with said substrate, said separation chamber
including a first inlet port;
filter means associated with said separation chamber;
a first mixing chamber in fluid communication with said separation chamber,
said first mixing chamber including a second inlet port ;
a second mixing chamber in fluid communication with said separation
chamber, said second mixing chamber including a third inlet port;
a first detection chamber in fluid communication with said first mixing
chamber, said first detection chamber including a capture zone; and
a second detection chamber in fluid communication with said second mixing
chamber, said second detection chamber including a capture zone.